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LONG-TERM CONSEQUENCES OF CORONAVIRUS INFECTION (SARS-COV-2) IN WOMEN OF CHILDBEARING AGE

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Abstract

Introduction: The long-term effects of COVID-19 on women's general and reproductive health remain insufficiently studied.

Aim: To evaluate the overall and reproductive health status of women after COVID-19, as well as the prevalence and nature of long-lasting post-COVID symptoms.

Methods: A descriptive study was conducted using a questionnaire collecting data on age, height, health status before and after COVID-19, pregnancy and delivery outcomes, frequency of medical consultations, and duration and nature of post-COVID symptoms. Data analysis was performed with IBM SPSS Statistics 19.

Results: Approximately 80% (n≈239) of women aged 21–35 rated their pre-COVID health as good or better; after infection, the proportion of "very good" ratings decreased to 3.7%. Preterm births and miscarriages accounted for 32%. Post-COVID symptoms (fatigue, musculoskeletal pain, sleep disturbances, hair loss, reduced skin elasticity) persisted for more than 3 months in most respondents.

Conclusions: COVID-19 exerts a prolonged negative impact on the general and reproductive health of women of reproductive age. These findings emphasize the need for comprehensive evaluation and rehabilitation strategies post-infection.

Keywords: *COVID-19, women's health, reproductive health, post-COVID syndrome, long-term symptoms*

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Резюме

ДОЛГОСРОЧНЫЕ ПОСЛЕДСТВИЯ КОРОНАВИРУСНОЙ ИНФЕКЦИИ (SARS-COV-2) У ЖЕНЩИН ФЕРТИЛЬНОГО ВОЗРАСТА

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Введение: Долгосрочное влияние перенесенной коронавирусной инфекции (COVID-19) на общее и репродуктивное здоровье женщин остается недостаточно изученным.

Цель: Оценить общее и репродуктивное здоровье женщин после COVID-19, а также распространенность и характер постковидных симптомов.

Методы: Проведено описательное исследование с использованием анкетирования. Сбор данных включал возраст, рост, состояние здоровья до и после COVID-19, исходы беременности и родов, частоту обращений к врачам, длительность и характер постковидных симптомов. Анализ выполнен с помощью IBM SPSS Statistics 19.

Результаты: Около 80% (n≈239) женщин 21–35 лет оценивали здоровье до COVID-19 как хорошее или лучше; после инфекции доля «очень хороших» оценок снизилась до 3,7%. Преждевременные роды и выкидыши составили 32%. Постковидные симптомы (усталость, боли в мышцах и суставах, нарушения сна, выпадение волос, снижение упругости кожи) сохранялись более 3 месяцев у большинства респонденток.

Выводы: COVID-19 оказывает негативное длительное влияние на общее и репродуктивное здоровье женщин репродуктивного возраста. Полученные данные подчеркивают необходимость комплексной оценки и реабилитации после перенесенной инфекции.

Ключевые слова: *COVID-19, женское здоровье, репродуктивное здоровье, постковидный синдром, длительные симптомы*

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Түйіндеме

ФЕРТИЛЬДІ ЖАСТАҒЫ ӘЙЕЛДЕРДЕГІ КОРОНАВИРУСТЫҚ ИНФЕКЦИЯНЫҢ (SARS-COV-2) ҰЗАҚ МЕРЗІМДІ САЛДАРЫ

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Кіріспе: COVID-19 індетін бастан өткерген әйелдердің жалпы денсаулық жағдайы мен репродуктивтік функциясына әсері толық анықталмаған.

Мақсаты: COVID-19 індетін өткерген әйелдердің жалпы және репродуктивтік денсаулық жағдайын, ұзақ мерзімді постковидтік белгілердің таралуын бағалау.

Әдістер: Зерттеу сипаттамалық кескінді зерттеу үлгісінде жүргізілді. Респонденттерге жас, бой, COVID-19-ға дейінгі және кейінгі денсаулық жағдайы, жүктілік және босану нәтижелері, медициналық көмекке жүгіну жиілігі, постковидтік белгілердің ұзақтығы мен сипаты туралы сауалнама жүргізілді. Нәтижелер IBM SPSS Statistics 19 бағдарламасымен талданды.

Нәтижелер: 21–35 жас аралығындағы әйелдердің 80%-да (n≈239) жалпы денсаулық жағдайы COVID-19-ға дейін жақсы деп бағаланды (шамамен 80%), алайда аурудан кейін «өте жақсы» бағасы 3,7%-ға, «жақсы» 44,3%-ға дейін төмендеді. Мерзімінен бұрын босану және түсік жағдайлары 32%-ды құрады. Постковидтік белгілердің қатарында қатты шаршау, бұлшықет-буын аурулары, ұйқының бұзылуы, шаштың түсуі, тері серпімділігінің төмендеуі жиі байқалды. Көпшілігінде (шамамен 60%-дан астам) белгілер 3 айдан аса уақытқа созылды.

Қорытынды: COVID-19 әйелдердің жалпы және репродуктивтік денсаулығына ұзақ мерзімді теріс әсерін тигізеді. Алынған мәліметтер репродуктивтік жастағы әйелдерде постковидтік синдромның кешенді бағасы мен оңалту шараларының маңыздылығын көрсетеді.

Түйінді сөздер*: COVID-19, әйелдер денсаулығы, репродуктивтік денсаулық, постковидтік синдром, ұзақ мерзімді белгілер.*

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Introduction

The coronavirus infection caused by the SARS-CoV-2 virus presents a significant challenge to contemporary medicine and public health. Since 2020, the pandemic has assumed a global scale, profoundly altering the lives of millions. In addition to the conventional respiratory symptoms (dry cough, shortness of breath, fever), recent investigations have concentrated on the long-term repercussions of the COVID-19 epidemic, elucidating its effects on various bodily systems, including the reproductive system of women of childbearing age [1], [2].

The potential influence of SARS-CoV-2 on female reproductive health is posited to stem from the expression of angiotensin-converting enzyme 2 (ACE2) and transmembrane protease serine 2 (TMPRSS2) receptors in reproductive tissues, such as the ovary and endometrium. These receptors are integral to viral entry into cells and the regulation of physiological processes pertinent to fertility [3], [4]. The pronounced expression of ACE2 in the endometrium, coupled with its age-dependent characteristics, suggests an age-specific vulnerability to tissue infection, necessitating further inquiry [5], [6]. However, conflicting evidence regarding the absence of viral detection in vaginal and cervical tissues [7], [8] underscores the necessity of clarifying the mechanisms by which the virus impacts the reproductive system.

The ramifications of the COVID-19 pandemic on the hormonal system and menstrual cycle are currently subjects of active discourse within the scientific literature. The significance of investigating the long-term consequences of the COVID-19 pandemic on women of childbearing age is underscored by observed alterations in the menstrual cycle, diminished ovarian reserve in women over 35 years of age, and severe forms of the disease, as well as potential risks associated with the endometrium [9], [10]. Conversely, other studies indicate that hormonal profiles and ovarian reserve do not exhibit average changes in women experiencing mild disease manifestations [11], [12].

Infection has been demonstrated to influence the frequency, nature, and duration of menstrual cycles. Symptoms associated with post-COVID syndrome, including chronic fatigue and joint and muscle pain, have garnered widespread attention within the scientific community [13]. Women may exhibit heightened susceptibility to substantial changes in overall health relative to men. Moreover, COVID-19 may induce alterations in body mass, skin condition, hair loss, and other physical manifestations. The utilization of contraceptive methods and pregnancy planning assumes particular importance among women affected by COVID-19, as post-COVID complications may hinder safe conception and childbirth [14].

The COVID-19 pandemic has transformed the way patients seek medical care. Among women, there has been an increase in visits to healthcare professionals for preventive check-ups related to reproductive health, alongside a deterioration in overall health status. However, concerns persist regarding the availability and quality of medical care provided [15].

Additionally, the pandemic has profoundly affected psycho-emotional well-being. Women have reported elevated levels of anxiety, depression, and sleep disturbances, attributed not solely to the infection but also to stress arising from socio-economic fluctuations [16].

Although numerous international studies have examined the impact of COVID-19 on women's health, there exists a paucity of data reflecting the regional specificities of Kazakhstan [17]. This study aims to address this gap and formulate recommendations for enhancing the organization of gynecological care during the pandemic and post-pandemic periods. Consequently, this research will elucidate key aspects of the COVID-19 epidemic's impact on women's reproductive health, overall health, psycho-emotional state, and contraceptive use, while assessing the frequency of medical care-seeking behavior.

The primary objective of this study is to evaluate the long-term consequences of coronavirus infection (SARS-CoV-2) in women of childbearing age, with a particular emphasis on alterations in the menstrual cycle, ovarian reserve, and endometrium.

Objectives of the Study:

1. To ascertain the incidence of premature birth, miscarriage, and variability in menstrual cycle frequency among women affected by COVID-19.

2. To compare self-assessed general health status prior to and subsequent to COVID-19, and determine the prevalence of chronic fatigue, joint and muscle pain, and other symptoms associated with post-COVID syndrome.

3. To investigate the frequency and rationale behind women's visits to medical institutions, including gynecological assessments, following COVID-19.

4. To evaluate the influence of COVID-19 on psycho-emotional health (anxiety, sleep disturbances), physical changes (body weight, skin condition, hair loss), and challenges concerning contraceptive use and pregnancy planning.

The findings of this study will provide a foundation for addressing existing gaps in the understanding of the impact of COVID-19 on women's reproductive health and for the development of effective preventive and therapeutic measures.

Methodology

Type of Study

This study is a cross-sectional observational quantitative research aimed at examining the impact of COVID-19 on women's reproductive health in Kazakhstan. The collected data allowed for consideration of seasonal variations in respiratory diseases.

Participant Selection Method

Women who had previously contracted COVID-19 were selected from the initial population using a simple random sampling method. Participation in the study was voluntary.

Inclusion Criteria:

– Women aged 18–50 years;

– A confirmed COVID-19 diagnosis based on medical records;

– Provision of written informed consent [18].

Exclusion Criteria:

– Presence of severe chronic diseases that could influence the results (e.g., oncological diseases, hematologic disorders, uncontrolled diabetes);

– Pregnancy at the time of completing the questionnaire.

The initial calculations were based on the minimum sample size required for testing statistical hypotheses (significance level $\alpha=0.05$; statistical power $\beta=0.80$). A total of 607 participants were selected for the study, ensuring sufficient statistical power for the analysis.

Measurement Methodology

Data were collected using a questionnaire consisting of 30 questions, categorized as follows:

– Socio-demographic data (age, height, etc.);

– Subjective assessment of overall health status before and after COVID-19;

– Symptoms associated with post-COVID syndrome;

– Reproductive health and contraception usage.

All data were gathered in a standardized format through either personal interviews or online surveys.

Data Processing and Analysis Methods

Data were processed using IBM SPSS Statistics 19 software. The processing stages included: verifying data completeness and accuracy, calculating frequencies, means (M), standard deviations (SD), and medians (Me); hypothesis testing using parametric and non-parametric methods (Student's t-test for independent samples, chi-square test for categorical data analysis, correlation analysis using Pearson's coefficient for normal distribution and Spearman's coefficient for non-normal distribution).

The normality of distribution was assessed using the Shapiro-Wilk test. A significance level of $p<0.05$ was

considered statistically significant. Confidence intervals were also calculated for key parameters. When necessary, multivariate analysis methods were employed to interpret interrelationships.

Ethical Considerations

The study was conducted in accordance with the principles of the Declaration of Helsinki (2013 revision) and was approved by the relevant medical institution's ethics committee [19]. Participants provided written informed consent for participation and data processing. Personal information was anonymized and used solely for research purposes. All described methods were developed and applied in strict adherence to the study protocol, ensuring the possibility of replicating the study under similar conditions.

Results

The following data present the demographic analysis of the sample. The study group primarily consisted of women of active reproductive age (21–35 years) and of average height (mostly between 161–170 cm). Thus, the sample was relatively homogeneous in terms of age and anthropometric characteristics.

Analyzing age distribution, the majority of participants were aged between 21 and 35 years (approximately 80%). Women under 20 and over 40 were represented in minimal proportions, indicating that the sample was concentrated within the reproductive age range (Table 1).

Table 1

Age Structure Results.

Age	Number of Participants (N)	Percentage (%)
Under 20	1	0.3%
21–30	130	43.3%
31–35	109	36.3%
36–40	52	17.3%
Over 40	8	2.7%

The majority of respondents were between 161–170 cm in height (approximately 42%), while those ranging from 151–180 cm accounted for nearly 90% of the sample. No participants were shorter than 150 cm, while only 10% exceeded 180 cm in height.

Table 2

Distribution and Normality Test Results.

Variable	Mean (M)	Standard Deviation (SD)	Median (Me)	Shapiro-Wilk (p-value)	Normality (Yes/No)
Age	31.2	6.7	30	0.045	No
Height	165.3	5.8	165	0.134	Yes
General health before COVID-19	4.2	0.8	4	0.032	No
General health after COVID-19	3.7	0.9	3.5	0.021	No

The table above presents the distribution and normality of key quantitative variables. According to the Shapiro-Wilk test, the variables "age," "general health before COVID-19," and "general health after COVID-19" did not meet normality assumptions ($p < 0.05$). However, the "height" variable followed a normal distribution ($p = 0.134$). These findings indicate the need for non-parametric statistical methods.

Table 3

Correlation Analysis

Variables	Pearson (r)	Spearman (ρ)	p-value
Age ↔ General health before COVID-19	-0.35	-0.32	<0.001
Age ↔ General health after COVID-19	-0.42	-0.39	<0.001
Height ↔ General health after COVID-19	0.12	0.15	0.032

This table presents the correlation between key variables. A negative correlation was observed between age and general health before COVID-19 (Pearson's $r = -0.35$, Spearman's $\rho = -0.32$, $p < 0.001$), indicating that older women rated their health lower. Similarly, a negative correlation was found between age and general health after COVID-19 ($r = -0.42$, $\rho = -0.39$, $p < 0.001$). Additionally, a weak positive correlation was observed between height and general health after COVID-19 ($r = 0.12$, $\rho = 0.15$, $p = 0.032$), suggesting that taller women rated their health slightly better.

Table 4

Group Comparisons for Key Indicators

Variable	Group 1 (M ± SD)	Group 2 (M ± SD)	p-value (t-test)	p-value (Mann-Whitney)
General health before COVID-19	4.3 ± 0.7	3.9 ± 0.9	0.012	0.018
General health after COVID-19	3.8 ± 0.9	3.4 ± 1.1	0.045	0.054

The table presents the comparison results between groups. A significant difference was found in general health before COVID-19 between Group 1 (mean = 4.3 ± 0.7) and Group 2 (mean = 3.9 ± 0.9) ($p = 0.012$). A statistically significant difference was also observed in general health after COVID-19 ($p = 0.045$), indicating variations in post-COVID health conditions among different groups.

Table 5

Regression Analysis Results

Variable	Coefficient (B)	Standard Error (SE)	p-value	95% CI (Lower–Upper)
Age	-0.15	0.05	<0.001	-0.25 – -0.05
Post-COVID fatigue	-0.20	0.08	0.032	-0.36 – -0.04
General health before COVID-19	0.30	0.10	0.002	0.10 – 0.50

The results of the regression analysis show that older women had lower overall health levels (coefficient B = -0.15, p < 0.001), and those experiencing post-COVID fatigue also exhibited a decline in health (B = -0.20, p = 0.032). In contrast, better general health before COVID-19 had a positive effect on post-COVID health outcomes (B = 0.30, p = 0.002). The 95% confidence intervals confirm the statistical significance of these variables.

Table 6

Univariate Analysis.

Question No.	Category (Frequency >5%)	n	(%)
1	2	3	4
1. Your Age	21–30 years	130	43.3%
	31–35 years	109	36.3%
	36–40 years	52	17.3%
2. Your Height	151–160 cm	68	22.7%
	161–170 cm	127	42.3%
	171–180 cm	75	25.0%
	Above 180 cm	30	10.0%
3. Health Status Before Experiencing COVID-19	Very good	38	12.7%
	Good	202	67.3%
	Satisfactory	59	19.7%
4. Health Status After Experiencing COVID-19	Very good	11	3,7%
	Good	133	44.3%
	Satisfactory	152	50.7%
5. Pregnancy Outcome During COVID-19	Full-term birth (≥37 weeks)	204	68.0%
	Preterm birth (22–36.6 weeks)	91	30.3%
6. Number of Births During COVID-19	First	45	15.0%
	Second	58	19.3%
	Third or more	197	65.7%
7. Doctor Visits in the Last Year (After COVID-19)	No	172	57.3%
	Yes, once	119	39.7%
8. Reason for Doctor Visit	Acute illness	18	6.0%
	Feeling unwell	94	31.3%
	Preventive check-up	180	60.0%
9. Acute Respiratory Illness in the Last Year (Flu, etc.)	No	108	36.0%
	Yes, once	84	28.0%
	Yes, twice or more	108	36.0%
10. Presence of Chronic Diseases (Hypertension, Diabetes, etc.)	No	300	100%
11. Severe Fatigue, Weakness, Decreased Work Capacity	No	114	38.0%
	Yes, first 3 months	90	30.0%
	Yes, first 6 months	46	15.3%
	Yes, more than 6 months	50	16.7%
12. Muscle, Bone, and Joint Pain	No	116	38.7%
	Yes, first 3 months	91	30.3%
	Yes, first 6 months	46	15.3%
	Yes, more than 6 months	47	15.7%
13. Unusual Headaches	No	128	42.7%
	Yes, first 3 months	86	28.7%
	Yes, first 6 months	41	13.7%
	Yes, more than 6 months	45	15.0%
14. Visual Floaters, Dizziness, Tinnitus	No	131	43.7%
	Yes, first 3 months	95	31.7%
	Yes, first 6 months	36	12.0%
	Yes, more than 6 months	38	12.7%
15. Chest Pain, Palpitations, Blood Pressure Fluctuations	No	143	47.7%
	Yes, first 3 months	82	27.3%
	Yes, first 6 months	36	12.0%
	Yes, more than 6 months	39	13.0%
16. Excessive Sweating, Hot Flashes	No	132	44.0%
	Yes, first 3 months	92	30.7%
	Yes, first 6 months	37	12.3%
	Yes, more than 6 months	39	13.0%

Continuation of the table 1.

1	2	3	4
17. Chest Tightness, Breathing Difficulties	No	130	43.3%
	Yes, first 3 months	94	31.3%
	Yes, first 6 months	40	13.3%
	Yes, more than 6 months	36	12.0%
18. Unexplained Fear, Anxiety, Suicidal Thoughts	No	291	97.0%
19. Sleeping Difficulties (Insomnia at Night, Drowsiness During the Day)	No	122	40.7%
	Yes, first 3 months	95	31.7%
	Yes, first 6 months	42	14.0%
	Yes, more than 6 months	41	13.7%
20. Skin Rashes	No	292	97.3%
21. Hair Loss	No	112	37.3%
	Yes, first 3 months	90	30.0%
	Yes, first 6 months	47	15.7%
	Yes, more than 6 months	51	17.0%
22. Body Weight Changes (Weight Loss/Gain)	No	276	92.0%
	Yes, first 3 months	22	7.3%
23. Skin Dryness and Decreased Elasticity	No	133	44.3%
	Yes	167	55.7%
24. Libido Disorders	No	194	64.7%
	Yes, first 3 months	78	26.0%
	Yes, first 6 months	23	7.7%
25. Changes in Menstrual Regularity and Characteristics	No	239	79.7%
	Yes	61	20.3%
26. Difficulties in Planning the Next Pregnancy	No	232	77.3%
	Yes	68	22.7%
27. Postpartum Scheduled Gynecological Examination	No	236	78.7%
	Yes	64	21.3%
28. Abnormalities Detected During Routine Check-up	No	212	70.7%
	Yes	88	29.3%
29. Consideration of Pregnancy Planning Information	No	188	62.7%
	Yes	37	12.3%
	I don't know about such information	75	25.0%
30. Contraception if Not Planning the Next Pregnancy	No protection (nothing used)	190	63.3%
	Protection used (all methods combined)	110	36.7%
	Intrauterine device	97	32.3%

An analysis of respondents' overall health status before contracting COVID-19 revealed that approximately 80% rated their health as "good" or better. Specifically, 67.3% assessed their health as "good," 12.7% as "very good," and 0.3% as "excellent." Notably, no respondents rated their health as "poor" before the infection. However, after experiencing COVID-19, these ratings changed: the proportion of respondents rating their health as "very good" dropped to 3.7%, while those considering it "good" decreased to 44.3%. The "excellent" category disappeared entirely, and the "satisfactory" category increased to 50.7%, with 1.3% rating their health as "poor." This indicates a general deterioration in health following COVID-19.

Among women who were pregnant during the pandemic, 68% had full-term deliveries (≥37 weeks), while 30.3% experienced preterm births (22–36.6 weeks), and 1.7% had miscarriages after 12 weeks. These findings suggest that COVID-19 may have influenced pregnancy outcomes, increasing the risk of complications. Additionally, among women who gave birth during the pandemic, only 15% were first-time mothers, while 19.3% were experiencing their second childbirth, and 65.7% had their third or more childbirths, indicating a relatively experienced group of respondents.

The frequency of medical visits post-COVID-19 revealed that 57.3% of respondents did not consult a doctor in the past year, while 39.7% had one visit, and 3% sought medical attention twice or more. The reasons for seeking medical care were as follows: 60% underwent routine check-ups, 31.3% reported nonspecific discomfort, 6% sought care due to acute illness, and 2.7% required medical attention due to chronic disease exacerbation. Notably, none of the respondents had pre-diagnosed chronic diseases before the pandemic, which may require further investigation.

The incidence of acute respiratory infections in the year following COVID-19 varied: 36% did not experience any respiratory illnesses, 28% reported being sick once, and 36% suffered from respiratory infections twice or more. This suggests variable immune responses, where some individuals may have developed increased resistance to

respiratory pathogens, while others exhibited increased susceptibility.

A univariate analysis identified the widespread persistence of post-COVID symptoms over time. Overall, 62% of respondents reported experiencing severe fatigue, weakness, and reduced work capacity (30% within the first three months, 15.3% up to six months, and 16.7% beyond six months). Similar trends were observed for musculoskeletal pain (61.3%), headaches (approximately 57%), vision and hearing disturbances (56.3%), cardiac discomfort (52.3%), excessive sweating (56%), and respiratory difficulties (56.7%). Psycho-emotional disturbances were relatively rare (3%) but not entirely absent. Sleep disturbances were reported by 59.3% of respondents. Dermatological changes were infrequent (2.7%), but skin dryness and decreased elasticity were noted in 55.7% of cases. Hair loss was observed in 62.7% of respondents (30% within the first three months, 15.7% up to six months, and 17% beyond six months).

Reproductive health was also affected, with 20.3% reporting menstrual cycle irregularities and 22.7% experiencing difficulties in planning their next pregnancy. Libido disorders were reported by 35.3% (26% within the first three months, 7.7% up to six months, and 1.7% beyond six months). After childbirth during the pandemic, 78.7% of respondents did not undergo a scheduled gynecological examination, while 21.3% did, among whom 29.3% were diagnosed with abnormalities. Only 12.3% of respondents actively sought information about pregnancy planning, whereas 62.7% showed no interest, and 25% were unaware of such information. A significant proportion (63.3%) did not use any contraception, increasing the risk of unplanned pregnancies. Among those using contraception, 32.3% opted for intrauterine devices, 4.3% used hormonal methods, and no respondents reported using barrier methods.

For a more in-depth understanding, a multifactorial analysis (Appendix A) was conducted. This approach required grouping certain categories. For instance, while the univariate analysis categorized symptom duration into three periods (up to 3 months, up to 6 months, and beyond 6 months), the multifactorial analysis simplified this into two categories: "up to 3 months" and "more than 3 months." This helped streamline statistical modeling and better capture the long-term impact of symptoms. Similarly, preterm births and miscarriages were combined into a single 32% category, facilitating a more comprehensive evaluation of pregnancy complications.

Appendices 1.

Multifactorial Analysis Results.

Indicators		Group		p	CI [95% CI]
		Positive result	Negative result		
1. Your age:	Under 30 years old	131 (43,7%)	154 (51%)		-
	31-35 years old	109 (36,3%)	51 (16,9%)	0,059	0,23 [0,48-1,03]
	36-40 years old	52 (17,3%)	56 (18,5%)	0,666	0,52 [1,2-2,75]
	Above 40 years old	**8 (2,7%)**	**41 (13,6%)**	**<0,001**	**3,31 [14,73-65,58]**
2. Your height:	Up to 160 cm	68 (22,7%)	87 (28,8%)		-
	161-170 cm	127 (42,3%)	155 (51,3%)	0,476	0,4 [0,78-1,54]
	Above 171 cm	105 (35%)	60 (19,9%)	0,172	0,28 [0,59-1,26]
3. How would you rate your overall health before experiencing COVID-19?	Good	202 (67,3%)	228 (75,5%)		-
	Very good/excellent	39 (13%)	38 (12,6%)	0,510	0,25 [0,7-2]
	Satisfactory/poor	59 (19,7%)	36 (11,9%)	0,225	0,67 [1,93-5,59]
4. How would you rate your overall health after experiencing COVID-19?	Good	133 (44,3%)	202 (66,9%)		-
	Very good	11 (3,7%)	27 (8,9%)	0,724	0,33 [1,27-4,88]
	Satisfactory	156 (52%)	73 (24,2%)	0,233	0,21 [0,56-1,45]
5. If you were pregnant during the COVID-19 pandemic, how did your pregnancy end?	Full-term birth (≥37.0 weeks of pregnancy)	204 (68%)	285 (94,4%)		-
	Preterm birth (22.0-36.6 weeks of pregnancy), miscarriage	96 (32%)	17 (5,6%)	0,163	0,12 [0,42-1,42]
6. If you gave birth during the COVID-19 pandemic, which birth was it for you?	First	45 (15%)	66 (21,9%)		-
	Second	**58 (19,3%)**	**34 (11,3%)**	**0,016**	**0,12 [0,31-0,8]**
	Third or more	197 (65,7%)	202 (66,9%)	0,054	0,18 [0,42-1,02]
7. In the last year after having COVID-19, have you visited a doctor regarding your health?	No	172 (57,3%)	227 (75,2%)		-
	Yes, once	119 (39,7%)	54 (17,9%)	0,167	0,75 [1,97-5,14]
	Yes, two or more times	**9 (3%)**	**21 (7%)**	**<0,001**	**9,11 [93,57-961,18]**
9. In the last year after having COVID-19, have you experienced an acute respiratory illness (flu, parainfluenza, acute respiratory infections, acute respiratory viral infections)?	No	108 (36%)	232 (76,8%)		-
	Yes, once	**84 (28%)**	**32 (10,6%)**	**<0,001**	**0,04 [0,12-0,32]**
	Yes, two or more times	108 (36%)	38 (12,6%)	0,646	0,2 [0,73-2,75]
11. After having COVID-19, did you experience severe fatigue, general weakness, or reduced work capacity?	No	114 (38%)	261 (86,4%)		-
	Yes, in the first 3 months	90 (30%)	29 (9,6%)	0,073	0 [0,07-1,29]
	Yes, for more than 3 months	**96 (32%)**	**12 (4%)**	**<0,001**	**0 [0-0,07]**

Continuation ot he appendices 1.

1	2	3	4	5	6
12. After having COVID-19, did you notice the onset of muscle, bone, or joint pain?	No	116 (38,7%)	260 (86,1%)		-
	Yes, in the first 3 months	91 (30,3%)	29 (9,6%)	0,350	0,2 [4,29-91,36]
	Yes, for more than 3 months	93 (31%)	13 (4,3%)	0,221	0,27 [9,03-306,51]
13. After having COVID-19, did you experience non-specific headaches?	No	128 (42,7%)	259 (85,8%)		-
	Yes, in the first 3 months	86 (28,7%)	33 (10,9%)	0,971	0,08 [0,96-10,82]
	Yes, for more than 3 months	86 (28,7%)	10 (3,3%)	0,056	0 [0,05-1,08]
14. After having COVID-19, did you notice "floaters" in your vision, dizziness, tinnitus, or hearing loss?	No	131 (43,7%)	259 (85,8%)		-
	Yes, in the first 3 months	**95 (31,7%)**	**33 (10,9%)**	**0,013**	**2,49 [70,48-1997,32]**
	Yes, for more than 3 months	**74 (24,7%)**	**10 (3,3%)**	**0,024**	**1,77 [72,14-2945,56]**
15. After having COVID-19, did you experience chest pain, frequent heart palpitations, or changes in your usual blood pressure levels (either high or low)?	No	143 (47,7%)	262 (86,8%)		-
	Yes, in the first 3 months	82 (27,3%)	30 (9,9%)	0,113	0,58 [9,75-162,76]
	Yes, for more than 3 months	75 (25%)	10 (3,3%)	0,844	0,04 [1,45-59,97]
16. After having COVID-19, did you notice excessive sweating at night or during the day, or sudden hot flashes?	No	132 (44%)	264 (87,4%)		-
	Yes, in the first 3 months	92 (30,7%)	27 (8,9%)	0,645	0,14 [1,83-23,96]
	Yes, for more than 3 months	76 (25,3%)	11 (3,6%)	0,654	0,04 [0,54-8,04]
17. After having COVID-19, did you notice a feeling of chest tightness or breathing difficulties?	No	130 (43,3%)	263 (87,1%)		-
	Yes, in the first 3 months	**94 (31,3%)**	**29 (9,6%)**	**0,048**	**0 [0,05-0,98]**
	Yes, for more than 3 months	76 (25,3%)	10 (3,3%)	0,582	0,01 [0,36-13,78]
19. Since having COVID-19, have you had trouble sleeping (insomnia at night, drowsiness during the day)?	No	122 (40,7%)	259 (85,8%)		-
	Yes, in the first 3 months	95 (31,7%)	29 (9,6%)	0,951	0,05 [0,91-16,82]
	Yes, for more than 3 months	83 (27,7%)	14 (4,6%)	0,083	0,63 [32,66-1691,51]
21. After having COVID-19, did you notice hair loss?	No	112 (37,3%)	261 (86,4%)		-
	Yes, in the first 3 months	**90 (30%)**	**26 (8,6%)**	**0,002**	**0 [0,01-0,17]**
	Yes, for more than 3 months	**98 (32,7%)**	**15 (5%)**	**0,005**	**0 [0,01-0,21]**
23. Since having COVID-19, has your skin become dry and less elastic?	Yes	167 (55,7%)	35 (11,6%)		-
	No	133 (44,3%)	267 (88,4%)	0,079	0,81 [6,48-52,06]
24. After having COVID-19, did you experience libido disorders?	No	194 (64,7%)	266 (88,1%)		-
	Yes, in the first 3 months	78 (26%)	25 (8,3%)	0,306	0,4 [2,75-19,16]
	Yes, for more than 3 months	28 (9,3%)	11 (3,6%)	0,031	1,25 [11,39-103,98]
25. After having COVID-19, has the regularity and nature of your menstruation changed?	Yes	61 (20,3%)	5 (1,7%)		-
	No	239 (79,7%)	297 (98,3%)	0,203	0,46 [4,19-37,98]
26. After having a pregnancy/ delivery affected by COVID-19, did you experience difficulties in planning your next pregnancy?	Yes	68 (22,7%)	8 (2,6%)		-
	No	232 (77,3%)	294 (97,4%)	0,688	0,19 [1,53-12,12]
27. After pregnancy, did you undergo a routine gynecological examination ("screening"): gynecological consultation, ultrasound of pelvic organs, oncocytology, etc.?	Yes	64 (21,3%)	38 (12,6%)		-
	No	236 (78,7%)	264 (87,4%)	0,271	0,08 [0,41-2]
28. If you underwent a routine gynecological examination after pregnancy during the COVID-19 pandemic, were any abnormalities detected?	Yes	88 (29,3%)	13 (4,3%)		-
	No	212 (70,7%)	289 (95,7%)	0,063	0,91 [5,28-30,45]
29. Do you seek information on family planning?	Yes	37 (12,3%)	55 (18,2%)		-
	No	**188 (62,7%)**	**242 (80,1%)**	**0,032**	**0,09 [0,28-0,9]**
	I am not aware of such information	**75 (25%)**	**5 (1,7%)**	**<0,001**	**0 [0,01-0,12]**
30. If you are not planning your next pregnancy at this time, what contraception method do you use?	No contraception	190 (63,3%)	118 (39,1%)		-
	I use an intrauterine device	**97 (32,3%)**	**158 (52,3%)**	**<0,001**	**7,19 [15,15-31,9]**
	Other	**13 (4,3%)**	**26 (8,6%)**	**<0,001**	**4,07 [20,83-106,64]**

Categories that increase the chances of a positive outcome are marked in pink, while those that decrease the chances are marked in green.

For example, in the univariate analysis, prolonged fatigue was divided into 15.3% (up to 6 months) and 16.7% (beyond 6 months), whereas in the multifactorial analysis, these groups were merged into a single 32% category representing symptoms lasting more than three months. A similar pattern was observed for hair loss: the 15.7% (up to 6 months) and 17% (beyond 6 months) groups were combined into 32.7%. Sleep disturbances lasting beyond three months were recorded at 27.7%. This consolidation provided a clearer picture of long-term symptom persistence, aiding statistical analysis.

The multifactorial analysis (Appendix A) confirmed that many post-COVID symptoms persisted for more than three months, highlighting the long-term impact of COVID-19 on quality of life. Symptoms such as fatigue, hair loss, sleep disturbances, and respiratory difficulties were persistent among a significant proportion of respondents. Similarly, aggregating adverse pregnancy outcomes into a single category provided a clearer understanding of the pandemic's negative reproductive health effects.

Age was identified as a significant factor in health outcomes. Women over 40 years old had a significantly higher likelihood of negative outcomes, with 13.6% of this group experiencing complications compared to 51% among women under 30 years old ($p < 0.001$; OR = 3.31, 95% CI [14.73–65.58]). A statistically significant difference was also observed in the 31–35 age group, where the probability of a positive outcome was lower ($p = 0.059$; OR = 0.23, 95% CI [0.48–1.03]).

Height parameters were also analyzed, but no significant differences were found between groups. For example, the proportion of negative outcomes was 28.8% among women shorter than 160 cm, 51.3% among those 161–170 cm ($p = 0.476$), and 19.9% among women taller than 171 cm ($p = 0.172$).

Pre- and post-COVID health assessments significantly influenced outcomes. Among women who rated their pre-COVID health as "good," 75.5% experienced negative outcomes, compared to only 11.9% among those who rated their health as "satisfactory" or "poor" ($p = 0.225$; OR = 0.67, 95% CI [1.93–5.59]). Among women whose health worsened after COVID-19, the incidence of negative outcomes was 24.2% ($p = 0.233$; OR = 0.21, 95% CI [0.56–1.45]).

The data suggest a decline in quality of life following COVID-19, emphasizing the need for further research considering multifactorial models. As demonstrated in Appendix A, category consolidation facilitated the identification of stable and significant trends. The findings underscore the importance of rehabilitation, preventive measures, and informational campaigns for women affected by COVID-19.

Discussion. This study has demonstrated that women who have experienced COVID-19 exhibit a decline in overall health, along with the emergence or exacerbation of post-COVID symptoms, including psycho-emotional disorders, reproductive system changes, and specific patterns in seeking medical care. Furthermore, a significant proportion of respondents reported symptoms persisting for more than three months, indicating the presence of a prolonged post-COVID syndrome.

One of the novel and significant aspects of this research is the comprehensive nature of the observed changes, which encompass multiple dimensions, ranging from general well-being to reproductive health, sexual function, and dermatological aspects, including skin and hair conditions. Our findings align with certain international studies, confirming that post-COVID symptoms can persist over an extended period in individuals across various age groups, even in the absence of chronic diseases [4], [5], [14], [20]. However, previous studies have largely examined reproductive consequences in a fragmented manner, making direct comparisons challenging. The differences between our findings and some prior studies may be attributed to the nature of our sample, which primarily included women of reproductive age without officially registered chronic illnesses. This factor could influence susceptibility to post-COVID complications and the characteristics of reported symptoms. When comparing findings across studies, it is essential to consider inclusion criteria, socio-demographic background, and access to medical care.

A notable strength of this study lies in the detailed analysis of symptom dynamics post-infection, employing a multifactorial approach to integrate data and identify overarching trends. This methodology allowed for the monitoring of various health aspects—ranging from general well-being to reproductive changes—over an extended period, revealing the persistence or transformation of symptoms. Additionally, the inclusion of a population without evident chronic diseases helped minimize the confounding influence of comorbidities on the results.

Nevertheless, the study has several limitations. First, the reliance on survey-based data collection and the absence of objective clinical measurements complicate the validation of causal relationships between COVID-19 and the observed changes. Second, the sample predominantly comprised women of reproductive age, which restricts the generalizability of the findings to other age groups. Third, the lack of long-term follow-up data on the same respondents, as well as the absence of objective health assessments (such as laboratory or instrumental diagnostics), may limit the reliability of certain conclusions. Another drawback is the absence of a control group, which prevents a precise evaluation of the distinct characteristics of post-COVID symptoms. While these limitations should be taken into account when interpreting the results, they do not invalidate the study's key findings.

The findings underscore the necessity of close monitoring of women following COVID-19, particularly concerning reproductive health and long-term post-COVID manifestations. From a practical perspective, these results can facilitate the early detection and management of post-COVID disorders related to reproduction, sleep, and psycho-emotional well-being. However, the application of these findings in clinical practice requires an individualized approach, further confirmatory studies, and potential integration into future clinical guidelines.

Future research should expand the demographic scope, incorporating women of various ages and differing baseline health conditions. A promising direction involves a long-term, dynamic cohort study complemented by clinical and laboratory assessments. This approach would enable the identification of more precise predictors of prolonged post-COVID symptoms and their impact on reproductive

function. Additionally, new hypotheses may emerge regarding the underlying mechanisms of the observed changes, including potential immuno-hormonal alterations and their role in post-COVID syndrome development. However, such hypotheses remain preliminary and require further substantiation.

The interpretation of these findings should consider the primary aim of this study—to evaluate the impact of COVID-19 on women's general and reproductive health. While the data indicate the persistence of post-COVID changes, they do not provide sufficient evidence to draw conclusions about the long-term economic or social effectiveness of specific interventions. Nonetheless, the results emphasize the importance of a comprehensive rehabilitation approach for women recovering from COVID-19 and outline directions for further in-depth investigations.

Recommendations for Pregnancy Planning

Based on the study findings, recommendations for pregnancy planning post-COVID-19 have been developed. Women should undergo a thorough assessment of their general health status following COVID-19. This evaluation should include blood tests, hormonal assessments, and examinations of the cardiovascular and respiratory systems. The study indicates that a higher baseline level of preconception health increases the likelihood of favorable pregnancy outcomes.

Women should undergo routine gynecological examinations, including ultrasound assessments, oncocytology, and hormonal balance evaluations, as key steps in pregnancy preparation. According to the study data, women who did not undergo scheduled gynecological check-ups after COVID-19 were more likely to experience reproductive abnormalities ($p = 0.08$; OR = 0.41–2). Given COVID-19's substantial impact on the immune system, women are advised to maintain a diet rich in vitamins and minerals. Strengthening immunity through the intake of micronutrients such as vitamins D and C, iron, and zinc is particularly important.

The study findings also suggest that post-COVID psycho-emotional disturbances (e.g., insomnia, fatigue) may contribute to adverse health outcomes. Therefore, psychological support and, if necessary, professional counseling are recommended for affected women. Light physical activities, such as yoga or swimming, can enhance overall health and improve the body's readiness for pregnancy. This is particularly relevant for women experiencing post-COVID fatigue or weakness ($p < 0.001$; OR = 0.07, 95% CI [0–0.07]).

For women who do not plan to conceive following COVID-19 recovery, selecting appropriate contraceptive methods is crucial. According to the study results, women using intrauterine devices were more likely to experience favorable outcomes ($p < 0.001$; OR = 7.19, 95% CI [15.15–31.9]). Furthermore, comprehensive education on pregnancy planning is essential. The study found that women lacking adequate information had a higher likelihood of negative outcomes ($p < 0.001$; OR = 0.01, 95% CI [0.01–0.12]). Healthcare institutions should develop specialized programs to provide women with information on pregnancy planning and the potential long-term effects of COVID-19.

Conclusion. This study has demonstrated that COVID-19 infection in women of reproductive age is associated with a deterioration in overall health, along with the development of various post-COVID symptoms affecting reproductive function, psycho-emotional stability, and somatic and dermatological parameters. Some symptoms persisted for more than three months, contributing to the formation of a prolonged post-COVID syndrome. The findings highlight the importance of comprehensive medical surveillance, preventive strategies, and rehabilitation measures aimed at the timely identification and management of post-COVID disorders.

To gain a deeper understanding of COVID-19's long-term consequences and identify risk factors more precisely, further research is required. This should include long-term dynamic monitoring, objective clinical and laboratory assessments, and comparative analyses with control groups. Such studies will facilitate the development of effective medical strategies tailored to women recovering from COVID-19.

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